

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P3090PC00	FOR FURTHER ACTION See Form PCT/IPEA/416																									
International application No. PCT/FI2004/000372	International filing date (day/month/year) 16-06-2004	Priority date (day/month/year) 01-07-2003																								
International Patent Classification (IPC) or national classification and IPC G01W 1/14																										
Applicant Vaisala OYJ et al																										
<ol style="list-style-type: none"> 1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>5</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: <ol style="list-style-type: none"> a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>3</u> sheets, as follows: <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. </div> b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions). 4. This report contains indications relating to the following items: <table style="width: 100%; border: none;"> <tr> <td style="width: 10%;"><input checked="" type="checkbox"/></td> <td style="width: 20%;">Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> 			<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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Date of submission of the demand 02-05-2005	Date of completion of this report 19-09-2005																									
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000372

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 7 as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* 8 - 10 received by this Authority on 02 - 05 - 2005
- pages* _____ received by this Authority on _____
- ☒ the drawings:
- pages 2 as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000372

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-12</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-12</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-12</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

A WO 9800736 A1 (ALKA ELECTRONIC APS), 8 January 1998
B US 5016196 A (D.A.NELSON ET AL), 14 May 1991
C WO 03027719 A1 (VAISALA OYJ), 3 April 2003
D WO 03027720 A1 (VAISALA OYJ), 3 April 2003
E US 4245499 A (VAN DY NGUYEN ET AL),
F US 4747041 A (G.L.ENGEL ET AL), 24 May 1988
G US 4780843 A (D.L.TIETJEN), 25 October 1988
H US 4698748 A (D.L.JUZWIK ET AL), 6 October 1987

In a view of new claims amended at 02-05-2005 documents A - C are reconsidered to represent the state of the art, together with documents D - H.

The present invention discloses the method and device for hydrometeor detection where the mechanical impulses of hydrometeors falling on a detection surface are measured, and after the threshold value is exceeded the measuring apparatus is excited, thereby minimizing the power consumption of the apparatus.

Document A discloses a method for optical flow measuring of precipitation. The method includes collecting precipitation guided in form of drops to a fluid output via a measuring zone. Each drop in the measuring zone passes at least one optical path between optical transmitting device and optical receiving device, which outputs an electrical signal in dependence of the intensity of the light signal received at the optical receiver.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Box V

A control unit initiates a drop count register when the electrical signal exceeds a predetermined threshold value. Thereby low power consumption is achievable, because the system is in "idle-mode" when no drop is detected and is activated when the drop causes an exceeding of the predetermined threshold value of the electrical signal. (See page 4, line 9-36; page 9, line 29-page 12, line 5; claims 1,2).

Document B discloses a rain sampling device adapted for independent operation at locations remote from the user which allows rainfall to be sampled in accordance with any schedule desired by the user. A microprocessor which receives signals from instruments sensing wind speed, moisture, solar flux and temperature is also arranged to control the apparatus to be programmed to collect samples at predetermined times or when moisture is detected. Accordingly, the device is activated when the signal indicates that moisture is present and thereafter the system automatically initiates rain sampling program. Thereby lower consumption of the power is achievable. (See column 1, line 62-column 2, line 7; column 5, line 67-column 6, line 29).

Document C discloses also a rain detector and a method for precipitation rate measurement where the power dissipation of the measurement system can be minimized using a microprocessor designed to include a "sleep-mode" function. If no droplets are detected within a given time, the microprocessor sets the measurement electronics into a "sleep mode" of minimal power consumption. The microprocessor can be awakened by taking a control signal to a given input thereof. When rainfall detection takes place using a sensor, the voltage pulse delivered by the sensor may be used as the awaken signal, whereby the measurement electronics circuitry turns immediately to the measurement mode when the first raindrop falls on the rain detector. (See page 4, line 30-page 5, line 7).

However, none of the cited documents discloses method for detecting and measuring hydrometeors where the mechanical impulses of hydrometeors falling on a detection surface are measured and the mechanical disturbances are filtered out of the signal during processing by using an advanced signal analysis.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

In view of the cited documents such methods cannot be considered obvious to a person skilled in the art.

Therefore the invention claimed in claims 1 - 12 is novel and considered to involve an inventive step.

The invention is considered to be industrially applicable.

02-05-2005

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Claims:

IAP20 Rec'd PCT/PTO 30 DEC 2005

1. A method in connection with a measuring device detecting hydrometeors, in which method
 - the mechanical impulses of hydrometeors falling on a detection surface are measured,**characterized in that**
 - part of the measuring device (1) is used to perform a continuous measurement, in order to define a threshold value for an impulse,
 - only after the threshold value is exceeded is the final part (2) of the measuring apparatus excited for measuring operations, in order to minimize the power consumption of the apparatus, and
 - mechanical disturbances are filtered out of the signal during processing, on the basis of one or more characteristic features of a hydrometeor signal.
2. A method according to Claim 1, **characterized in that** the final part (2) of the measuring apparatus is returned to an inactive state immediately after a measurement.
3. A method according to Claim 1 or 2, **characterized in that** pulse-specific measurement data is recorded (4) in the initial part (1) of the measuring apparatus, so that the final part can read it after excitation.
4. A method according to Claim 1 or 2 or 3, in which, in a first time window (10) after the definition of the threshold value, a first parameter of the impulse, such as the amplitude or rate of change of the pulse, is defined, **characterized in that**, in a second, later time window (11), the same parameter is defined from the impulse and the first and second time-window parameters are compared with each other, in order to eliminate spurious signals.
5. A method according to Claim 4, **characterized in that** the ratio between the first (10) and second (11) time windows is created as the limit value for a spurious signal.

6. A method for measuring hydrometeors, in which method the mechanical impulses of hydrometeors falling on a detection surface, and which exceed a predefined threshold value, are measured, in which case a first parameter such as amplitude or the rate of change of the pulse is defined in a first time window after the definition of the threshold value, **characterized** in that, in a second, later time window (11), the same parameter is defined from the impulse and the first and second time-window parameters are compared with each other, in order to eliminate spurious signals.
7. A method according to Claim 6, **characterized** in that the ratio between the first (10) and the second (11) time window is created as the limit value for a spurious signal.
8. A method for measuring hydrometeors, in which method
- the mechanical impulses of hydrometeors falling on a detection surface, and which exceed a predefined threshold value, are measured,
 - the initiation of the measurement is triggered in connection with pulses exceeding the threshold value,
 - in connection with triggering, at least one initial parameter, such as amplitude or the rate of change of the pulse, is defined from the impulse,
- characterized** in that, after the first measurement, the time is measured which elapses before the parameter has reached a predefined value relative to the initial value of the parameter, and this time is used as a characteristic parameter in filtering.
9. A method for measuring hydrometeors, in which method
- the mechanical impulses of hydrometeors falling on a detection surface, and which exceed a predefined threshold value, are measured,
 - the initiation of the measurement is triggered in connection with pulses exceeding the threshold value,
 - in connection with triggering, at least one initial parameter, such as amplitude or the rate of change of the pulse, is defined from the impulse,
- characterized** in that
- the triggering level of the hydrometeor-signal detection circuit (3) is adjusted on the basis of the wind velocity, in such a way that the amplitude of spurious

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signals caused by the wind remains below the triggering level.

10. A measuring device for detecting hydrometeors, which includes

- a detector part (1), which, in turn, includes
 - a detection element (6), for detecting impacts caused by hydrometeors,
 - an amplifier circuit (5), for amplifying the output signal of the detection element (6),
 - a limit-value circuit (3), for triggering the measurement of impulses exceeding a specific signal level, and
- a processor part (2) for processing the triggered signals,

characterized in that

- the detector part (1) is arranged to perform continual measurement, in order to define the threshold value of the impulse,
- the processor part (2) is arranged to be excited to measurement operations only when the threshold value is exceeded, in order to minimize the power consumption of the measuring apparatus, and that
- the device includes means for filtering out mechanical disturbances of the signal during processing, on the basis of one or more characteristic features of a hydrometeor signal.

11. An apparatus according to Claim 10, **characterized** in that the processor part (2) of the measuring apparatus is arranged to return to an inactive state immediately after measurement.

12. An apparatus according to Claim 10 or 11, **characterized** in that the detector part includes memory means (4) for recording pulse-specific measurement data, which the processor part can read after excitation.